

PHYSICS

# Gravity and Electricity Are Merged in New Mathematics

## Countryman of Einstein Uses New and Curious Geometry To Bring Together Diverse Fields of Physics

**U**NIFICATION of the laws of electricity and magnetism with those of the gravitational field, a problem upon which Prof. Albert Einstein and other mathematical physicists have been working, was given a possible solution by Prof. Cornelius Lanczos, visiting professor of Purdue University, who made his announcement before the American Mathematical Society meeting in Columbus, Ohio, last week.

This new "field-theory" promises to arouse great interest in science circles because of the recognized need of linking Einstein's theories of relativity with magnetism and electricity. Previous attempts, even those announced by Einstein some two years ago, have not been considered wholly successful.

Prof. Lanczos, who as professor at the University of Frankfurt, Germany, is a countryman of Prof. Einstein's, derived from the same principle two different functions, one of which leads to gravitation and the other to electromagnetism. Thus it appears that he has brought together the two diverse fields of physics that have heretofore developed so fruitfully along parallel lines.

The fascinating feature of Einstein's general theory of relativity, Prof. Lanczos said, was that it gave a satisfactory explanation of gravitation on purely geometrical grounds. For this purpose, a new and curious kind of geometry, called Riemann's geometry, had to be introduced into physics in place of the long-familiar Euclid's geometry.

Prof. Lanczos has made a further extension of the Riemannian geometry to physics. He makes the supposition that the "principle of least action," which has a very wide application in physical science, also exists in the Riemann space.

Two formulae result from this operation. One of these leads to the laws of gravitation, Prof. Lanczos said. The other gives the new and consistent explanation of the laws of electricity and magnetism.

Thus a new theoretical basis for physics has been set up which welds several diverse fields into a whole.

Previous attempts to generalize Einstein's point of view with respect to electromagnetism have met with great difficulties, according to Prof. Lanczos.

"At present, however," he stated, "no evidence has appeared which would tend to show a probable connection between this field theory and modern quantum theory."

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PHYSICS

## Electromagnetism Explained By Riemannian Geometry

By PROF. CORNELIUS LANCZOS OF Frankfurt University and Purdue University

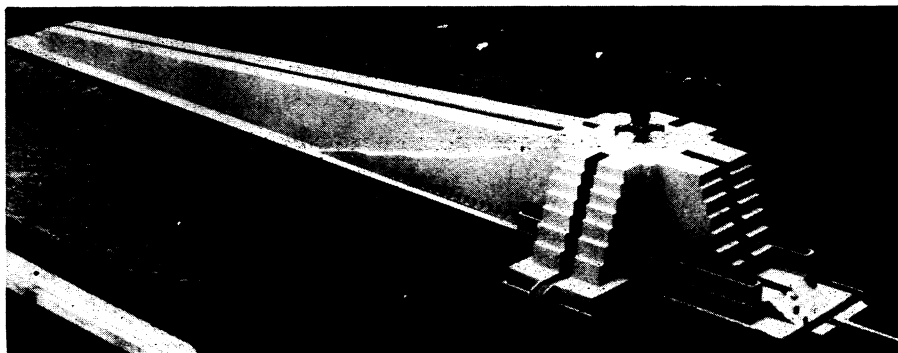
**EDITOR'S NOTE:** Prof. Lanczos explains that this problem can be really understood only by mathematical explanations. This review emphasizes the most essential features without becoming merely superficial. For people deeply interested in this matter, this summary can give a certain idea.

**T**HE FASCINATING feature in Einstein's theory of general relativity is that some very general and logically satisfying points of view give a complete explanation of the physical phenomena of gravitation. The fundamental idea giving the key to the solution of

the problem of gravitation was the introduction of a new kind of geometry called Riemannian geometry into physics in place of the Euclidian geometry. This geometry is governed by field-equations and corresponds in this way to the general feature of physics which is built up in its different branches upon field-equations. It was expected from the very beginning that electromagnetism must also have a place in this structure. It would be very clarifying if we could understand the peculiar character of "aether" to be an agency without any substance, if it should turn out that the laws of the aether are *geometrical* laws. Because even the absolutely empty space must be connected with a geometrical structure.

However, to generalize Einstein's point of view with respect to electromagnetism seemed to be connected with great difficulties. The fundamental quantity of the electromagnetic field, the field-intensity, shows a kind of symmetry which is not in accordance with the symmetry of Riemann's geometry. For this reason several attempts were undertaken to leave the Riemannian basis of geometry in order to construct a geometry upon a still more general basis. However, all these geometries do not possess the great inner consequence and logical necessity of Riemann's geometry. A really satisfactory solution by this means has never been found.

It seems that there also exists another way to find a solution of this problem. We can prove generally that Riemann's geometry is necessarily connected with a quantity which has a fundamental role in the theory of the electromagnetic field. It is not the electromagnetic field-strength but a quantity from which this can be deduced. This quantity appears



**MEMORIAL TO COLUMBUS**

Prize-winning design of a lighthouse and air beacon for the island Santo Domingo, the first land formally occupied by Columbus in the New World. It is the work of J. L. Gleave, of Nottingham, England, and because of its simple lines and stability against earthquakes won the \$10,000 first prize in the international competition of the Pan-American Union. The memorial, together with a park and an airport, is expected to cost about \$4,000,000.

as a necessary consequence of Riemann's geometry, when one only makes the supposition that there exists a "principle of least action" the domination of which we observe everywhere in physics. It is very surprising that choosing the simplest form of this principle in Riemann's geometry which is suggested by a very natural requirement, we find a combination of two functions, one of which leads to gravitation and the other to electromagnetism.

We considered here only the fundamental facts of electromagnetism, viz. those connected with the field. A later elaboration must show whether there exists a possibility of understanding the inner structure of matter through this new unification of gravitation and electricity. The reason for this is that the whole theory is based upon the idea that the equations which we have found are

valid *everywhere*, without exception. The special character of "matter" can be understood only as a consequence of the fact that there are certain small regions in space where the field-intensity becomes very high and the usual approximation which is permitted in weak fields and which corresponds to the classical laws of the electromagnetic field, is no longer valid. These regions are to be considered as the representation of material particles. We can expect to explain in this way in particular the fundamental identity of the change of every electron, and possibly in general the existence of universal constants in nature.

At present no evidence has yet appeared which would tend to show a probable connection between this field-theory and modern quantum-theory.

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## CHEMISTRY

## Third Competitor Enters Race for Missing Element 87

**B**LINDNESS threatening Prof. Gustave A. Aartovaara of Helsingfors, Finland, in his search for the missing chemical element 87, has aroused the anxiety of scientists of the U. S. Bureau of Standards, who have been working with him in seeking one of the last two remaining building blocks of the universe. Glass fragments severely injured his eyes as a result of an explosion of his apparatus, reports state.

As a third competitor in the race to identify this elusive metallic element, Prof. Aartovaara of the Helsingfors Technical University, had sent a sample of his preparation to be examined by Dr. W. F. Meggers of the U. S. Bureau of Standards, whose report on the optical spectrum has just been announced. The announcement comes on the heels of a rival claim by Prof. Jacob Papish of Cornell University, who declared he found the missing alkali in the rare mineral samarskite. The third contestant for the honor of completing the chemists' periodic table is Prof. Fred Allison of the Alabama Polytechnic Institute, who first announced the discovery of the missing alkali about a year ago, through the use of a magneto-optic method of his own invention.

No specific evidence that the Finnish preparation actually contains number 87 has been found, Dr. Meggers an-

nounced, though the spectra of all the related alkali metals, including sodium and potassium, were found. The crucial lines in the optical spectrum, he declared, will lie in the infra-red region where investigation is troublesome. Only the X-ray spectrum, used by the Cornell scientists, can decide the question definitely, in Dr. Meggers' opinion.

On the other hand, Dr. Meggers doubts whether Prof. Papish has given convincing measurements actually proving the existence of number 87 in his extract.

Prof. Aartovaara's substance differs from those of Prof. Allison and Prof. Papish in that it is radioactive, as might be expected from its nearness to radium in the periodic table of chemical elements. The reported explosion that injured Prof. Aartovaara is believed to have been due to the action of the radioactive rays on the solution.

Chemists recall, however, that a radioactive alkali solution was examined in 1908 for the missing element by the German chemist, Ebler. None was found. The activity was due to a trace of a known radioactive element.

Similar hopes entertained by investigators about radioactive alkali preparations have all been unfulfilled in the past.

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## ASTRONOMY

## Faint Nebulae May be Most Distant Objects

**A** GROUP of faint nebulae, just visible through the large reflecting telescope of the Bergedorf Observatory, Hamburg, has been discovered by Dr. Walter Baade. He believes them to be considerably more distant than another group of faint nebulae, like those in the constellation of Ursa Major, the great bear, which he discovered several years ago. These have been shown, by astronomers at the Mt. Wilson Observatory, to be about 70 million light years distant.

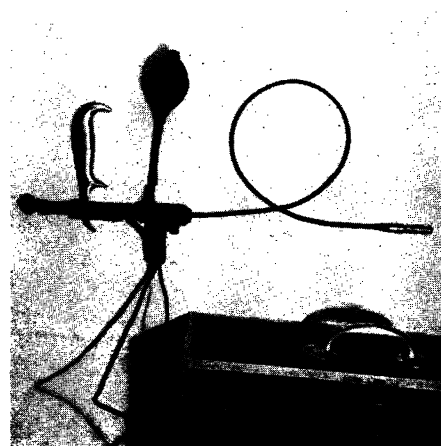
Only one more distant group of objects have been measured—some nebulae in the constellation of Leo, the lion—which appears to be about 105 million light years away. If the Ursa Major group is more than this, it will be the most distant object known to astronomers. The newly discovered nebulae are within a distance of about half a degree, the diameter of the moon, of the star Merak, the pointer farthest from the pole star, at the corner of the great dipper diagonally opposite the handle.

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## MEDICINE

## Camera and X-Rays Used to Locate Ulcers in Stomach

**A** COMBINATION of X-rays and a tiny camera which is lowered into the stomach now gives the physician or surgeon a means of determining more exactly the location of ulcers or other lesions in the stomach, Dr. P. E. Thal



### EIGHT STOMACH PICTURES

Are taken within the little bulb on the end of the spiral tube after it has been inserted in the organ.